

Tambja and *Roboastra*

(Mollusca : Opisthobranchia)

from the Gulf of California and the Galápagos Islands

BY

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(20 Text figures)

EVELINE AND ERNST MARCUS and James R. Lance published a description of *Nembrotha eliora* Marcus & Marcus, 1967, and *Nembrotha hubbsi* Lance, 1968, respectively. The papers describe the same animal species as shown by photographs, illustrations, and descriptions. Further work now shows that Marcus & Marcus' *N. eliora* was described from 2 lots of material. Their "material one" is similar to Lance's species and therefore *N. hubbsi* is considered a junior synonym of *N. eliora*. The Marcuses have 2 species in their description. Their "material two" is of a new species of *Tambja*. Lance's *N. hubbsi* also involves 2 different species. His description of *N. hubbsi* is correct, except the radula figure is that of a *Roboastra*.

The members of the genus *Nembrotha* as used by Marcus & Marcus have denticles or serrations on the leading edge of the teeth. In *Tambja*, the leading edge of the rachidian is smooth.

NUDIBRANCHIA

Doridoidea

PHANEROBRANCHIA

NONSUCTORIA

GYMNODORIDIDAE

Tambja Burn, 1962

Type species: *Nembrotha* (?) *verconis* BASEDOW & HEDLEY, 1905; 29: 146, 158, 159; pl. 2, figs. 1 - 3

"Rachidian is rectangular with notched or smooth up-

per margin, lateral tooth has a bifid or simple cusp with 3 - 7 marginal plates. The buccal collar is strong; a labial armature is absent. The small prostate gland is confined to a glandular section of the vas deferens." (BURN, 1967: 214).

Tambja eliora (Marcus & Marcus, 1967)

(Figures 1 - 3, 18)

Nembrotha eliora MARCUS & MARCUS, 1967: 194 - 196; figs. 57, 58; - FARMER, 1968: 26, 27 (fig.); - 1970a: 16; - 1970b: 73, 75, 78 (figs. 6, 8), 79, 84; - 1970c: 5, 12, figs.; - KEEN, 1971: 827, 828; pl. XX, fig. 3; - ABBOTT, 1974: 358; - SKOOLUND, 1974: 5

Nembrotha hubbsi LANCE, 1968: 6 - 8; pl. 1, fig. 6

Syntypic material (*eliora*): the holotype number is USNM 678410 and radular slide no. 915.6. One specimen and its radula are represented. The type of *N. hubbsi* is an intact specimen, CASIZ type series no. 315. The radula illustrated is of a *Roboastra* from another specimen no longer intact.

Type Locality: Puerto Lobos, Sonora, Mexico.

Distribution: Angel de la Guarda Island, Guaymas, Escondido Bay, Carmen Island, Monserrate Island, San



Figure 1

Tambja eliora (Marcus & Marcus, 1967)

Diego Island, Punta Entrada, Espiritu Santo Island, La Paz, Cerralvo Island, and Magdalena Bay, Mexico.

Description: The radula, based on a minimum of specimens, is typically that of a *Tambja* with the formula $15 \times 5 - 4 \cdot 1 \cdot 1 \cdot 1 \cdot 4 - 5$ (Figure 2). No labial armature

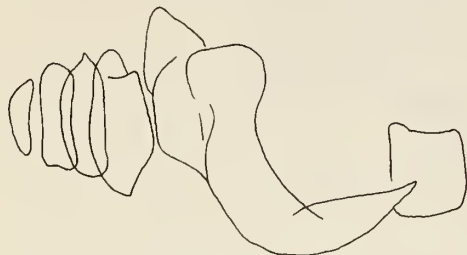


Figure 2

Radula of *Tambja eliora* (Marcus & Marcus, 1967)

is evident. The animal can attain a length of 50 mm and is limaciform. The foot color is gray; the edge of the foot is blue. Three marked turquoise blue stripes on the dorsum are bordered by black. The rhinophores have 22 leaves. The gills are unipinnate and nearly black in color; the axis of the gills is marked with turquoise, black, and yellow ochre. The morphology of the head is characteristic in this animal where the cephalic shield dips into a "V" or "U" shape (Figure 1). The cephalic tentacles are broad and flat.

A dorsal orientation of the reproductive system shows many of the parts in surface view. Carefully teasing the organs apart (Figure 3), the atrium is found to be enlarged. The hermaphrodite duct leads into the large vaginal gland by way of an ampulla. A thin sac-like structure is connected to the nidamental duct as is the adjacent round spermatheca.

Behavior: *Tambja eliora* swims by undulating the body from side to side (FARMER, 1970b). This is an escape response to the advances of the predatory slug, *Roboastra tigris* Farmer (spec. nov., herein) (Figure 18). Other possible reasons for swimming are not known.

Discussion: The "material one" of MARCUS & MARCUS, 1967, is compatible with the above description. Their "material two" is also part of the original material, but it represents another species, which is described below as *Tambja abdere*.

Lance's work with *Nembrotha hubbsi* was nearly concurrent with that of Marcus & Marcus, although each was unaware of the other's involvement.

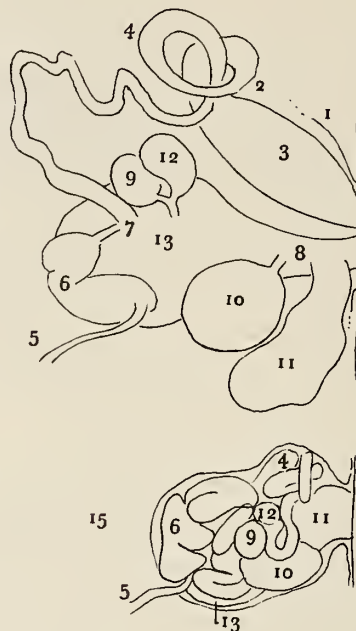


Figure 3

Gonads of *Tambja eliora* (Marcus & Marcus, 1967)

- | | | |
|----------------------|----------------------------------|------------------|
| 1 - capsule membrane | 2 - penis | 3 - atrium |
| 4 - prostate | 5 - hermaphrodite duct | 6 - ampulla |
| 7 - oviduct | 8 - nidamental duct | 9 - spermatocyst |
| 10 - spermatheca | 11 - Sac | 12 - Ampulla |
| 13 - vaginal gland | 15 - gonad in dorsal orientation | |

Specimen distribution of *Tambja eliora* and the number of specimens include:

- CASIZ 003565 San Pedro Island, 32 km N of Guaymas, Mexico, in 24-27 m of water. Leg. Bill Van Zandt, (2 specimens).
- USNM 709790 San Pedro Island, 32 km N of Guaymas, Mexico, in 24-27 m of water. Leg. Bill Van Zandt, (1 specimen).
- LACMNH 71-14 3-15 m, east side of Punta Entrada at Sail Rock (N entrance to Magdalena Bay), Baja California, Mexico (24° 32.4' N, 112° 04' W). Leg. James H. McLean, 30-31 January, 1971. (1 specimen).
- LACMNH 16904 La Paz area, Baja California, Mexico. Leg. Edwin Janss, May, 1972 (3 specimens).
- LACMNH A.9942 Near Escondido Bay, Carmen Island, Baja California, Mexico. Leg. Carl Gage and Chuck Fisher, March 28, 1974. (1 specimen).
- LACMNH A.9555 Isla Monserrate, Baja California, Mexico. Leg. Edwin Janss, April, 1974. (2 specimens).
- LACMNH A.9555 13.5 m, S end of Isla San Diego, Baja California, Mexico. Leg. Edwin Janss, April, 1974. (6 specimens and 1 *Tambja abdere* Farmer).
- SDMNH 63051 Isla Monserrate, Baja California, Mexico, April 13, 1969. Leg. Bill Van Zandt, (1 specimen).
- DMNH 92182 San Pedro Island, 32 km N of Guaymas, Mexico in 24-27 m of water, April, 1969. Leg. Bill Van Zandt, (1 specimen).
- BMNH 197936 San Pedro Island, 32 km N of Guaymas, Mexico in 24-27 m of water, April 13, 1969. Leg. Bill Van Zandt. WMF # 650. (1 specimen).
- WMF 651 San Pedro Island, 32 km N of Guaymas, Mexico, 24-27 m of water. Leg. Bill Van Zandt, April 13, 1969. (12 specimens).

Tambja abdere Farmer, spec. nov.

(Figures 4 - 6)

Nembrotha eliora MARCUS & MARCUS, 1967: 195 (original "material two" only)*Nembrotha* sp. FARMER, 1970a: 16**Holotype:** CASIZ No. 687. An egg mass is also included.**Paratypes:** USNM 709791; LACM 1717; SDSNH 63052; DMNH 92183; and BM[NH] 997838.**Type Locality:** La Paz, Baja California, Mexico. Edwin Janss, Jr., coll. May 1972.**Distribution:** Punta Lobos, Guaymas, Danzante Island, San Diego Island, San Francisco Island, and La Paz, Mexico.

Figure 4

Tambja abdere Farmer, spec. nov.

Description: The 80mm long type specimen is limaci-form (Figure 4). The sole of the foot is brown and the foot margin is ochre. The general color is yellow ochre with 4 distinct areas of turquoise, 2 on each side and 2 dorsal. These areas extend the length of the body, and within them are irregular patches of yellow ochre. Between the turquoise and yellow ochre is black. The head shield is horizontal across the front. Two flat cephalic flaps under the head shield of yellow ochre have turquoise between them. The blue-black rhinophores are retractile into highly set shields. The eye spots are prominent and blue-black. The gills (one unipinnate and 2 bipinnate) are dark and are set on a yellow ochre axis anterior to the anus. The radular formula, based on a minimum of preparations (Figure 5) is $17 \times 4 \cdot 1 \cdot 1 \cdot 1 \cdot 4$. The labial armature is weak.

Dorsal observation of the reproductive system shows surface areas and placement of the organs before they are teased apart. The penis is a narrow structure proximally. Distally the spring-like prostate narrows to a very thin tube at its apex (Figure 6) and descends through the center of the coils, merging into an ampulla. The hermaphrodite duct leads into the vaginal gland by way

of an enlarged, convoluted ampulla. A small round spermatocyst is connected to the nidamental duct at the site of

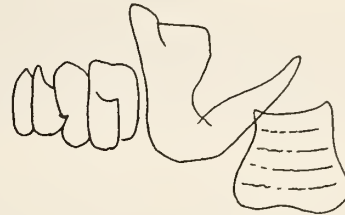


Figure 5

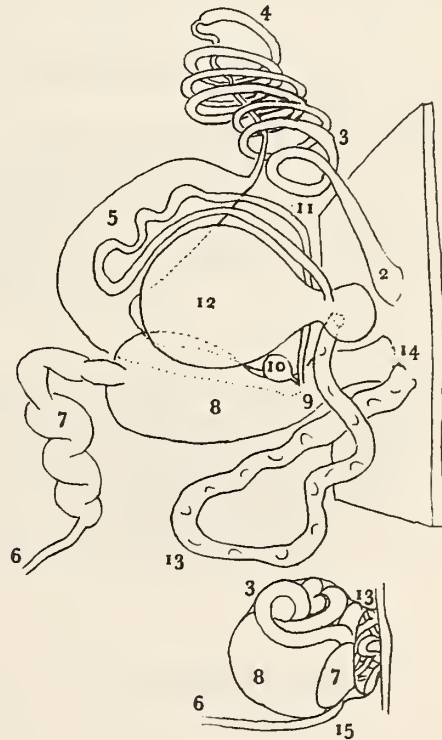
Radula of *Tambja abdere* Farmer, spec. nov.

Figure 6

Gonads of *Tambja abdere* Farmer, spec. nov.

- | | | |
|--------------------------------|-------------------|----------------------------------|
| 1 - capsule membrane | 2 - penis | 3 - vas deferens |
| 4 - prostate | 5 - ampulla | 6 - hermaphrodite duct |
| 7 - ampulla | 8 - vaginal gland | 9 - nidamental duct |
| 10 - spermatocyst | | 11 - insemination duct |
| 12 - spermatheca | | 13 - vagina |
| 14 - aperture of outer oviduct | | 15 - dorsal orientation of gonad |

the insemination duct. The long insemination duct connects at a small bulbous portion of the bi-bulbar spermatheca. Also connected to this small bulbar area of the spermatheca at the opposite side is the lengthy vagina.

Behavior: *Tambja abdere* secretes great amounts of a substance from numerous goblet cells found in the skin. The reaction, triggered by the advances of *Roboastrea*, is depicted in Figure 19.

Discussion: This species represents the "number two" material of MARCUS & MARCUS, 1967. The authors did not illustrate the species, and it was presented only in the text. However, the text revealed the difference between the 2 materials. This difference was seen in Dr. Pickens' photographs as well as in the text. *Tambja eliora* has blue-black rhinophoral sheaths and dark foot margins; *T. abdere* has yellow or yellow ochre sheaths and "bright yellow" foot margins.

Specimen distribution of *Tambja abdere* and the number of specimens included are:

- CASIZ 687 La Paz area, Baja California, Mexico. Leg. Edwin Jans. Microscope slide of radula No. 497 specimen egg mass included. (1 specimen).
 USNM 709791 La Paz area, Baja California, Mexico, May, 1972. Leg. Edwin Jans. (1 specimen).
 LACM 1717 La Paz area, Baja California, Mexico, May, 1972. Leg. Edwin Jans. (1 specimen).
 LACM A.9555 Subtidal, Isla de San Francisco, Baja California, Mexico. Leg. Edwin Jans, February, 1974. (Specimen label incorrectly labeled *Roboastrea*. 3 specimens).
 SDSNH 63052 La Paz area, Baja California, Mexico, May, 1972. Leg. Edwin Jans. (1 specimen).
 DMNH 92183 La Paz area, Baja California, Mexico, May, 1972. Leg. Edwin Jans. (1 specimen).
 BMNH 197438 San Pedro Island, 32 km N of Guaymas, Mexico in 24 - 27 m of water, April 13, 1969. Leg. Bill Van Zandt. (1 specimen).
 WMF 461 La Paz, Baja California, Mexico, 19 April, 1964. Leg. Richard Adcock. (1 specimen).

Etymology: The specific name *abdere*, which is Latin and Greek, meaning "away from" and "skin," is selected to call attention to the ability of the animal to produce copious amounts of defensive secretions.

Tambja fusca Farmer, spec nov.

(Figures 7 - 9)

Holotype: CASIZ No. 688. It consists of a dissected animal and a radula slide.

Paratypes: USNM 709792; LACM 1719; SDSNH 63052; DMNH 92184; and BM[NH] 197435.

Type Locality: Isla Monserrate, Baja California, Mexico; Edwin Jans, Jr. coll. April 1964.

Distribution: Concepción Bay, La Paz, and Cabo San Lucas, Baja California, Mexico.



Figure 7

Tambja fusca Farmer, spec nov.

Description: The 40 - 50 mm long animal is limaciform (Figure 7). The sole margin is ochre and is bordered by a black line. The general color is a dark yellow ochre with areas of turquoise of an irregular pattern. Between the ochre and turquoise is a thin line of black. The retractile rhinophores are ruddy with dark tips. They have 19 leaves. One unipinnate and 2 bipinnate gills are set about half way on the back of the animal. The gills are dark tipped with slightly lighter areas attached to the ochre axis of the gill supports. The anal papilla is located just posterior of and next to the gills. The eye spots are dark in color, easily recognizable, and set posterior of and medial to the rhinophores.

The radular formula, based on a minimum of preparations, is $15 \times 4 - 3 \cdot 1 \cdot 1 \cdot 1 \cdot 3 - 4$ (Figure 8). A thin labial armature is present.



Figure 8

Radula of *Tambja fusca* Farmer, spec. nov.

Viewing the reproductive system dorsally before the capsule membrane is removed, many tubules and a wide surface of the vaginal gland are observed. Careful teasing of the system reveals the spermatheca to be bi-bulbar (Figure 9) with a relatively short insemination duct. The spermatocyst is attached to the insemination duct, but not directly to the vaginal gland. The spring-like coils of the vas deferens and prostate surround the thin ascending

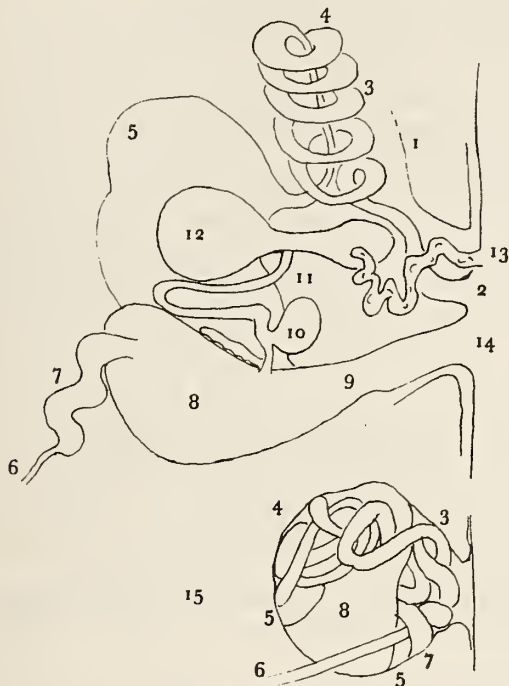


Figure 9

Gonads of *Tambja fusca* Farmer, spec. nov.

- | | | |
|----------------------|----------------------------------|------------------------|
| 1 - capsule membrane | 2 - penis | 3 - vas deferens |
| 4 - prostate | 5 - ampulla | 6 - hermaphrodite duct |
| 7 - ampulla | 8 - vaginal gland | 9 - nidamental duct |
| 10 - spermatocyst | 11 - insemination duct | 12 - spermatheca |
| 13 - vagina | 14 - aperture of outer oviduct | |
| | 15 - gonad in dorsal orientation | |

tube from an ampulla. The hermaphrodite duct leads into the vaginal gland through a thicker ampulla.

Discussion: The lateral teeth variations are from 3 - 4 in *Tambja fusca*, and only 4 laterals in *T. abdere*. The first tooth appears to be more robust in *T. fusca* than in *T. abdere*.

Specimen distribution of *Tambja fusca* and the number of specimens identified include:

- CASIZ 688 Isla Monserrate, Baja California, Mexico. Leg. Edwin Janss, April, 1974. Radula on microscope slide No. 498. (1 specimen).
 USNM 709792 Isla Monserrate, Baja California, Mexico, April, 1974. Leg. Edwin Janss. (1 specimen).
 LACM 1719 Isla Monserrate, Baja California, Mexico. April, 1974. Leg. Edwin Janss. (1 specimen).
 LACM A-9555 Gulf of California. Leg. Edwin Janss, 1972. (Not a *Roboastra* as per LACM label, 1 specimen).
 SDSNH 63053 Isla Monserrate, Baja California, Mexico. April, 1974. Leg. Edwin Janss. (1 specimen).

- DMNH 92184 Isla Monserrate, Baja California, Mexico. April, 1974. Leg. Edwin Janss. (1 specimen).
 BMNH 197435 La Paz area, Baja California, Mexico. April, 1972. Leg. Edwin Janss. (1 specimen).
 WMF 649 San Pedro Island, 32 km N of Guaymas, Mexico. April 13, 1969. Leg. Bill Van Zandt. (4 specimens).

Etymology: The specific name *fusca*, the feminine form of the Latin adjective *fuscus* (meaning dark, blackish) is selected to emphasize the relatively dark coloration of *Tambja fusca* as compared to the lighter color of *T. abdere*.

Tambja mullineri Farmer, spec. nov.

(Figures 10 - 12)

Holotype: CASIZ No. 689, a dissected specimen and a microscope radula slide.

Paratypes: LACM 1718; SDSNH 63052; DMNH 92185; BM[NH] 197437.

Type Locality: Academy Bay, Santa Cruz Island, Galápagos Islands, Ecuador. David Mulliner and Gale G. Sphon, coll. 18 March, 1971.

Distribution: James Island; Jerris Island; Academy Bay, Santa Cruz Island; NW Onslow Island, and Floreana, Galápagos Islands.

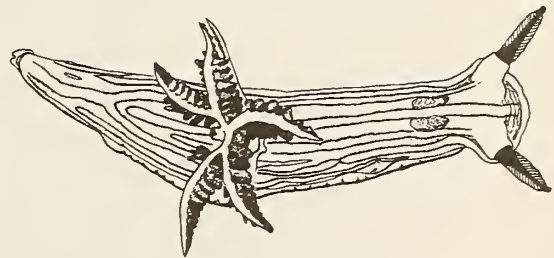


Figure 10

Tambja mullineri Farmer, spec. nov.

Description: The 15 mm long animal is limaciform (Figure 10). The foot of the living animal is like the general background color of ochre-turquoise grading into a lighter shade. Broad turquoise stripes are bordered by a thin line of navy blue. The colors are noted from a photograph by David K. Mulliner.

The one unipinnate and 2 bipinnate gills are navy blue with a light ochre-turquoise trunk supporting the gill filaments. A wide turquoise stripe extends from the gill,

anteriorly between the rhinophores, to the cephalic rim. How the stripe ends anteriorly is not known since it has not been observed in relaxed living material or photo-

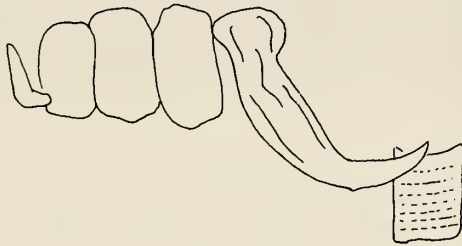


Figure 11

Radula of *Tambja mullineri* Farmer, spec. nov.

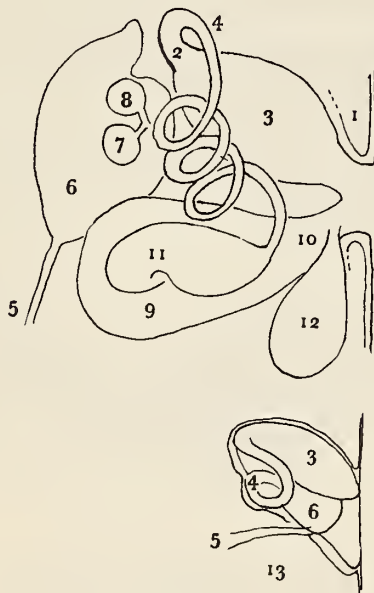


Figure 12

Gonads of *Tambja mullineri* Farmer, spec. nov.

- 1 - capsule membrane 2 - penis 3 - atrium 4 - prostate
5 - hermaphrodite duct 6 - ampulla 7 - spermatotheca
8 - spermatotheca 9 - vaginal gland 10 - nidamental duct
11 - ampulla 12 - vagina 13 - gonad in dorsal orientation

graphed from the front. Two dark areas are behind the rhinophores adjacent to the medial stripe.

The rhinophores are navy-blue with ochre-turquoise leaves. The rhinophoral sheaths are thick and stout in appearance. The blunt navy-blue tipped rhinophores have 12 or 13 leaves; they are retractile. The eye spots are moderately dark.

The reproductive system, viewed dorsally with the capsule membrane intact, shows a large atrium extending to the far side. At this point, the prostate arises with a loop descending into the inner part of the mass. The hermaphrodite duct enters the mass posteriorly about $\frac{1}{3}$ the distance from the inside of the snail. Teasing apart of the reproductive system (Figure 12) reveals a large atrium and coiled prostate of uniform diameter connected to an ampulla. This ampulla rests on and is connected to the vaginal gland. The hermaphrodite duct connects to a large ampulla. A small round spermatotheca of equal size and shape and the spermatotheca join to this ampulla by a common duct. This ampulla's connection to the rest of the system has yet to be uncovered.

The radular formula (Figure 11) from a few preparations is $15 \times 4 \cdot 1 \cdot 1 \cdot 1 \cdot 4$. The labial armature is moderately stout.

Discussion: *Tambja mullineri* is similar to *T. eliora* in appearance. The frontal veil suggests a uniform sweep across the animal, unlike that of *T. eliora* which dips down the front of the head. The blue stripes are wider in *T. mullineri* than in *T. eliora*. The first lateral tooth in *T. mullineri* has a hook, but it is absent in *T. eliora*.

The distribution of specimens of *Tambja mullineri* and the number of specimens identified include:

- CASIZ 689 Academy Bay, Santa Cruz Island, Galápagos Islands, Ecuador, on a reef in 22-30 m of water. Leg. Los Angeles County Museum of Natural History # 18171, August 26, 1974. Radula on microscope slide, No. 499 (1 specimen).
LACM 1718 James Bay, James Island, Galápagos Island, Galápagos Islands, March, 1971. Leg. Los Angeles County Museum of Natural History, (1 specimen).
LACM 1718 Jerris Island, Galápagos Islands, March, 1971. Leg. Los Angeles County Museum, David K. Mulliner and Gale Sphon. (1 specimen).
LACM 16905 On nullipores, North West of Isla Onslow, Floreana Island, Galápagos Islands, Ecuador, in 20 m. Leg. Gerard M. Wellington, January 13, 1975. Dissected gonad. (2 specimens 13 mm long each).
SDSNH 63056 Jerris Island, Galápagos Islands, March, 1971, in 10.5 m of water. (1 specimen).
BMNH 197437 Academy Bay, Santa Cruz Island, Galápagos Islands, Ecuador, in 22-30 m of water on reef, March 18, 1971. Leg. Los Angeles County Museum of Natural History. (1 specimen).

Etymology: *Tambja mullineri* is named for David K. Mulliner, a member of the Ameripagos Expedition, whose photographs have been useful in this study.

Roboustra Bergh, 1877

Type species: *Roboustra gracilis* Bergh, 1877: 458; pl. 56; fig. 12

"Oral tentacles are strongly developed as dorsolaterally grooved cylindrical projections equal in length to the rhinophores. Rachidian teeth are reduced to three prongs of well defined denticles. The lateral tooth is deeply bifid. Marginal plates are reduced and linear, 1 - 3 in number. The buccal collar is very weak. A labial armature is absent. A small prostate gland is confined to a coiled glandular section of the vas deferens." (BURN, 1967: 215).

Roboustra tigris Farmer, spec. nov.

(Figures 13 - 19)

Roboustra sp. FARMER, 1970a: 16

Holotype: CASIZ No. 690; it is entire. A microscope slide of the radula from another animal is with the specimen.

Paratypes: CASIZ No. 691; LACM 1720; SDSNH 63054; DMNH 92186; and BM[NH] 197439.

Type Locality: San Pedro Island, 32 km N of Guaymas, Sonora, Mexico, in 24 - 27 m.

Distribution: Los Angeles Bay, Guaymas, Monserrate Island, San Diego Island, and La Paz, Mexico.



Figure 13

Roboustra tigris Farmer, spec. nov.

Description: The 200 to 300 mm long animal is limaci-form (Figure 13). The sole is blue-black; the foot margin is blue. The basic color is yellow ochre with 5 black stripes bordered by bluish green. The sides may have an interrupted stripe. The retractile rhinophores are blue-black, surrounded by a rhinophore sheath, also blue-black. The

cephalic tentacles are placed anterior laterally and folded with the rib of the fold downward. The eye spots are generally bluish in color and well defined. The anterior cephalic shield is marked by a slight ridge.

The radular formula, based on a few microscope slide preparations, is $35 \times 4 - 3 \cdot 1 \cdot 1 \cdot 1 \cdot 3 - 4$. The radula is typically that of a *Roboustra*. The rachidian tooth has lateral prongs. The lateral teeth vary in number from 3 or 4 and are without prongs (Figure 14). LANCE (1968)

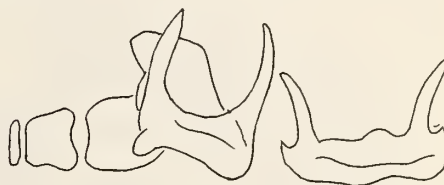


Figure 14

Radula of *Roboustra tigris* Farmer, spec. nov.

figures *Roboustra* radula for *Nembrotha hubbsi* or *Tambaja* (*Nembrotha*) *eliora*. One should also keep in mind that there is another *Roboustra* species living in the Gulf of California.

The oral area is cobalt blue and everts to surround its prey. Two cephalic tentacles are internal, proximal to the mouth. The radula is distal to the mouth in the buccal cavity (Figure 17).

The body is primarily a hydrocoel, which plays an important role in the swift eversion of the buccal envelope used to capture prey (Figures 18, 19).

The digestive system is a centrally located tube in the coelomic cavity. There is a digestive gland at the junction of the esophagus and stomach. The intestine has its insertion antero-dorsally to the stomach.

The cephalic ganglia produce 4 neurons of large diameter involving the external cephalic tentacles and the rhinophores.

The genital pores are located on the right side and are cobalt blue. Viewing the encapsulated reproductive system from the dorsal side, the hermaphrodite duct and ampulla overlying the vaginal gland can be seen. The round spermatheca, vas deferens and prostate are also seen at the surface. The teased reproductive system (Figure 15) shows a uniform diameter vas deferens and slightly larger diameter prostate connected to a thin tube, the oviduct. The ampulla from the hermaphrodite duct is also connected to the oviduct. The elongate spermatocyst and round spermatheca are situated over the large vaginal gland. An ampulla is attached to a Y-shaped tube leading

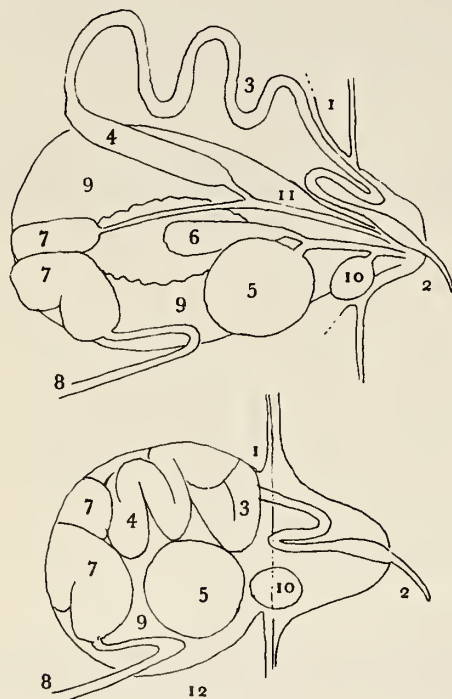


Figure 15

Gonads of *Roboastra tigris* Farmer, spec. nov.

- 1 - capsule membrane 2 - penis 3 - vas deferens
- 4 - prostate 5 - spermatheca 6 - spermocyst
- 7 - ampulla 8 - hermaphrodite duct 9 - vaginal gland
- 10 - ampulla 11 - oviduct 12 - gonad in dorsal orientation

from the spermocyst and spermatheca. The penis is armed with hooks (Figure 16). The 5 unipinnate gills are blue-black; the anus is centrally located.

An underwater photograph by Boris Innocenti clearly indicates that *Roboastra tigris* attains a length of 300 mm.



Figure 16

Penial hooks of *Roboastra tigris* Farmer, spec. nov.

The large size of this predatory slug might be linked to its feeding mechanism. A slug of such large size has mostly fluid within the coelomic cavity. This reservoir of fluid can be used to operate the rapid eversion of the buccal envelope to capture the rapidly swimming *Tambja eliora*.



Figure 17

Roboastra tigris Farmer, spec. nov.

Illustrations of moribund specimen (a, e, f)

- h - oral tentacle, swellings indicate mode of peristalsis along the length of the oral tentacle m - mouth ot - oral tentacle
- be - buccal envelope r - radula

In the type species description no mention is made of the feeding apparatus seen in *Roboastra tigris*. The oral tentacles are strongly developed as dorso-laterally grooved cylindrical projections. *Roboastra tigris* has these projections; however, they cannot be called oral tentacles; they might rightly be called cephalic projections since the oral tentacles are inside the buccal area behind and above the

mouth. The oral tentacles are not merely static organs but undergo peristalsis as illustrated in Figure 17h.

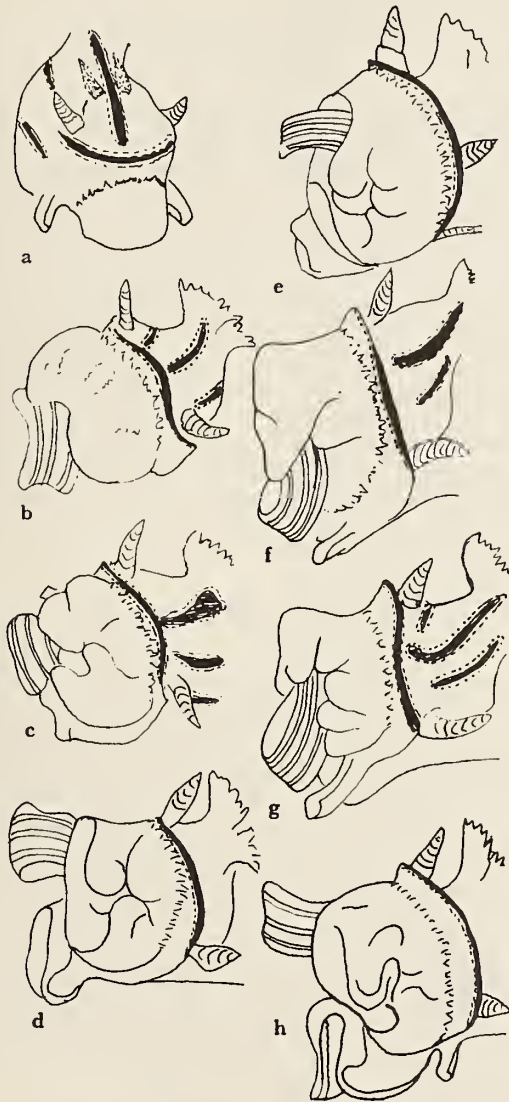


Figure 18

Sketches from selected motion picture frames of *Roboastra tigris* capturing *Tambja eliora*

Behavior: *Roboastra tigris* is photographically recorded as attempting to feed on a large specimen of *Tambja ab-*

dere (Figure 19). Motion pictures of one feeding on *T. eliora* are partially illustrated here. It is the first known nudibranch as a predator of another nudibranch. It is known to live in a rocky environment and to attain a size of 300mm. *Chelidonura inermis* (Cooper, 1862), a cephalaspidian, also preys upon sea slugs.

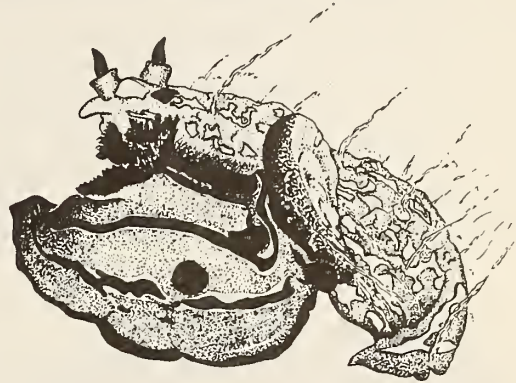


Figure 19

Roboastra tigris attempting to capture *Tambja abdere*

A color photograph illustrating the unusual feeding behavior of *Roboastra tigris* is reproduced in *Sea Frontiers* as *Nembrotha* sp.

The distribution of specimens of *Roboastra tigris* and the number of specimens identified are as follows:

- CASIZ 690 San Pedro Island, 32 km N of Guaymas, Mexico in 24-27 m of water. April 13, 1969. Leg. Bill Van Zandt. WMF 650. (1 specimen).
- CASIZ 691 La Paz, Baja California, Mexico, 1964. Leg. Dick Adcock. WMF 392. A specimen and microscope slide of radula No. 500.
- USNM 708793 La Paz, Baja California, Mexico. May, 1972. Leg. Edwin Janss. (1 specimen).
- LACM 1720 San Pedro Island, 32 km N of Guaymas, Mexico in 24-27 m of water, April 13, 1969. Leg. Bill Van Zandt. WMF 650. (1 specimen).
- LACM 16906 La Paz, Baja California, Mexico. Leg. Edwin Janss. April, 1972. (1 specimen).
- LACM A.9555 S End of Isla San Diego, Baja California, Mexico, in 13.5 m. Leg. Edwin Janss, April, 1974.
- LACM A.9555 Isla Monserrate, Baja California, Mexico. Leg. Edwin Janss, April, 1974. (1 specimen).
- SDSNH 63054 San Pedro Island, 32 km N of Guaymas, Mexico, in 24-27 m of water, April 13, 1969. Leg. Bill Van Zandt. WMF 650. (1 specimen).
- DMNH 92186 La Paz area, Baja California, Mexico. May, 1972. Leg. Edwin Janss. (1 specimen).
- BMNH 197439 San Pedro Island, 32 km N of Guaymas, Mexico in 24-27 m of water, April 13, 1969. Leg. Bill Van Zandt. WMF 650. (1 specimen).
- WMF 392 La Paz, Baja California, Mexico. 1964. Leg. Richard Adcock. (1 specimen).
- WMF 650 San Pedro Island, 32 km N of Guaymas, Mexico. 24-27 m of water. April 13, 1969. Leg. Bill Van Zandt. (1 specimen).

Etymology: *Roboastra tigris* is so named for its stripes and carnivorous appetite similar to the tiger.

Roboastra sp.

(Figure 20)

Edwin Jans snapped a photograph of *Roboastra* sp. near La Paz in June 1972 (Figure 20). It shows an animal similar to *Roboastra tigris*, but differing in detail of color and patterns, suggesting that another species of *Roboastra* may be present in the Gulf of California. Unfortunately, the specimen was devoured by one of its *Roboastra* companions in transit from the field to the laboratory. A strong resemblance in dorsally grooved oral tentacles (or cephalic tentacles) is noted between the "new" species and *Roboastra*. However, it differs by having orange-tipped rhinophores, white gills, and many more stripes on the body.

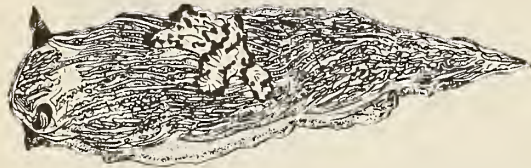


Figure 20

Roboastra sp.

Color Notes: The limaciform animal is about 60mm long. The edge of the foot is blue-black; the body is marked with numerous stripes of yellow ochre and bluish-black. Some of the stripes are lighter in shade. The eye spots are white. The cephalic basal folds are blue-black. The base of the rhinophores is blue-black with a similar core; the leaves are bright orange. The rhinophores are tipped in blue-black; the gills are blue-black distally and white proximally. There are 5 unipinnate gills. The mouth area could not be seen in the photographs.

Abbreviations used are:

BM[NH] – British Museum [Natural History]
 CASIZ – California Academy of Sciences, Invertebrate Zoology
 DMNH – Delaware Museum of Natural History
 LACM – Los Angeles County Museum of Natural History
 SDSNH – San Diego Society of Natural History

USNM – United States National Museum
 WMF – Wesley M. Farmer collection.

Key to the Eastern Pacific Species
 of *Roboastra* and *Tambja*

- 1 Mouth anterior and centrally located in the head 2
- Mouth located antero-ventrally near the foot 3
- 2 Rhinophores blue-black, black stripes on body few, bordered by light blue *Roboastra tigris*
- Rhinophores red, stripes on body numerous *Roboastra* sp.
- 3 Frontal veil horizontal 4
- Frontal veil dips into "V" or "U" shape *Tambja eliora*
- 4 Turquoise blue areas with "islands" of yellow ochre 5
- Turquoise blue stripes with "islands" of yellow ochre; both stripe colors of equal width *Tambja mullineri*
- 5 Yellow ochre dark, turquoise blue areas with "islands" of yellow ochre appearing "irregular" with variable interface between ochre and turquoise *Tambja abdere*
- Yellow ochre light, turquoise blue areas with "islands" of yellow ochre appearing "organized" with uniform appearing interface between ochre and turquoise *Tambja fusca*

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The author described the species; his wife, Michaelene Farmer, worked with the historical aspects of the manuscript.

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